Ge30 Plus Detector Setup Program
Users' Manual

The Ge30 Plus Detector Setup Program enables users to display an MCA trace, set up SCA windows, and measure detector energy resolution for the 30-element Germanium detector.

This manual contains instructions for setting up the Ge30 software as well as detailed descriptions of all features and functions performed. Most users do not need to use many of these features, so there is also a guide available with instructions for the basic functions. Please consult "Ge30 Plus Detector Setup Program – Quick Guide" first if you simply need instructions for displaying an MCA trace and setting SCA windows.

SMB-XAS Detector Support Contact Information

For assistance in windowing the Germanium detector or using the Ge30 Plus Detector Setup Program, please contact –

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For specific questions or comments regarding the Ge30 Plus Detector Setup software (program function, bug reports, etc.), please contact Allyson Soo Hoo directly.

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Setting Up Ge30 Software

Setup Instructions

Because there is no portable 30-element Germanium detector, all Ge30 software should already be installed and set up as needed. These setup instructions should only be used if modifications are made to the existing system. For installation instructions or additional help with setting up the Ge30 software, please contact Allyson Soo Hoo directly.

1. Using a privileged account, change directory to the directory where Ge30 is installed. On S073, this is SSRL$LOCAL:[GEDET.GE30_RUN2002].

    > $ SET DEF SSRL$LOCAL:[GEDET.GE30_RUN2002]

2. Edit the MCACREATE.COM file and enter the ICB addresses of the AIMs. Make a note of the detector configuration names used for each AIM.
3. Check the MCADELETE.COM file to ensure that the configuration names match the names in the MCACREATE.COM file.
4. Check the SETUP_DETAPP.COM file to ensure that all logicals and symbols are defined correctly.
5. Edit the DETECTORSETUP.DET file:
    a. The detector configuration name should be the first item in the file – this should be the name of the AIM that is connected to the ADC and was defined in the MCACREATE.COM file. The configuration is typically defined as DET05.
    b. The number of elements should be the total number of active detector elements that will be used. For example, if the detector has 30 elements, but two are dead, enter 28 for the number of elements.
    c. For each element, enter its ICB address. They should be entered in order of element number. The ICB address will be of the form NI[*AIM Address*]:[*ICB Module Address*]. Each Amp/TCA should be connected to an AIM through the ICB bus. The AIM Address is the Ethernet address located on the front of that AIM module. The ICB Module Address is a character from 0 through F located on the side of the Amp/TCA. Every module that is connected to a given AIM should have a unique ICB Module Address. Up to 16 devices can be connected to an AIM at a time.
    d. Enter the hex scaler information for each element. There should be four columns of data, with a row for each detector element's SCA 1, SCA 2, and ICR hex scaler information. The first column contains the data type – "FF", "F0", or "ICR". The second column contains the element number. The third column contains the hex scaler number and the fourth column contains the hex scaler subaddress. The number of rows should be three times the number of elements. If a second set of windows ("F0") is not being used, enter any hex scaler number and channel – they must be in the file, but they will be ignored.
    e. Enter the total number of hex scalers on the system.

f. Enter the ICS name of the real time clock.
g. Enter a 1 if the second set of windows is being used, 0 if not.
h. Enter the detector geometry information. There should be a row for each detector element containing the (x, y) coordinates of the button and label positions in the main window. Following the button and label coordinate information are the x and y positions, and the height and width of the button group.

6. If necessary, edit the SSRL$LOGIN.COM file.
   $ SET DEF SSRL$LOCAL:[MANAGER]
   $ EVE SSRL$LOGIN.COM

   Add the following command to the end of the file -
   $ @SSRL$LOCAL:[GEDET]SETUP_GE.COM

   Test this by opening a new DECterm. There should be no error messages upon logging in.

SCA Calibration

Important: Users should not attempt to calibrate the SCA windows. Please contact SMB-XAS detector support staff if you would like more information on the calibration process or if you believe the calibration may be inaccurate.

When setting up a detector for the first time, the SCA and display settings must be calibrated.

1. Move the MONO to 12000 eV and fully tune the monochromator.
2. Place a Mo reference foil in the beam. If the incoming count rate is too high (> 110,000 counts per second at 0.125 _Sec shaping time), move the detector back or insert Al filters. Press the **Start** button in the MCA CONTROL section of Ge30.
3. Turn the SCA 1 window on by pressing the SCA 1 toggle button in the SCA CONTROL section. Press the **AntiCoin.** button to display the spectrum in Anti-Coincidence.
4. Select **Calibrate SCA** from the **Electronics** menu. Press **Ok** in the message window that appears. When the window is opened, the SCA window settings are changed to the values shown in the **LL** and **UL SCA Bits** text fields. These values are in terms of bits (0-4095), not eV. To change these values, enter the new LL and UL SCA bits to set and press <**Enter**>. This will reset the SCA windows to the new position. Note: The default values are generally sufficient and do not need to be changed.
5. Enter 1 in the **Element** text field and press <**Enter**>.
6. Adjust the fine gain on amplifier 1 in the detector electronics rack so that the Mo fluorescence peaks highlight the SCA window.
7. Find the MCA channels that correspond to the lower and upper edges of the SCA window. Enter the channels in the **SCA 1 Ch. LL** and **UL** text fields and press

the **<u>Apply</u>** button or press **<Enter>** on the keyboard. Once the values have been applied, the original SCA window is reset.

8. Repeat Steps 5-7 for all other detector elements.
9. Once all the SCA windows have been calibrated, close the SCA Calibration window by pressing the **<u>Close</u>** button.
10. Align all amplifier gains by following the procedure on page 12 of this document.
11. Turn the SCA 1 window off by pressing the SCA 1 toggle button in the SCA CONTROL section. Turn SCA 2 on.
12. Select **<u>Calibrate SCA</u>** from the **<u>Electronics</u>** menu.
13. Enter 1 in the **Element** text field and press **<Enter>**.
14. Find the MCA channels that correspond to the lower and upper edges of the SCA window. Enter the channels in the **SCA 2 Ch. LL** and **UL** text fields and press the **<u>Apply</u>** button or press **<Enter>** on the keyboard.
15. Repeat Steps 13-14 for all other detector elements.

SCA Calibration Window

Important: The detector will usually be checked at the 0.125 _Sec shaping time and in an energy range less than 24 keV. Changes in shaping time or amplifier gain could cause the calibration to be inaccurate.

Getting Started

Log into your account on the beam line computer and open a DECterm. To run Ge30, type:
> $ GE30

Because multiple users cannot access the AIM simultaneously, if the MCA configuration is not deleted when Ge30 exits, another configuration cannot be created the next time the program is run. For instance, if Ge30 crashes, the MCADELETE.COM command file will not be executed. The next time Ge30 is run, attempts to create a new configuration will be unsuccessful because the previous configuration has not been deleted. Therefore, if you encounter errors while attempting to run Ge30 and the Ge Detector Setup Program window does not appear, try issuing the command "MCADELETE" at the VMS prompt:
> $ MCADELETE
> $ GE30

Once Ge30 is successfully run, the Ge30 Plus Detector Setup Program Main Window will appear.
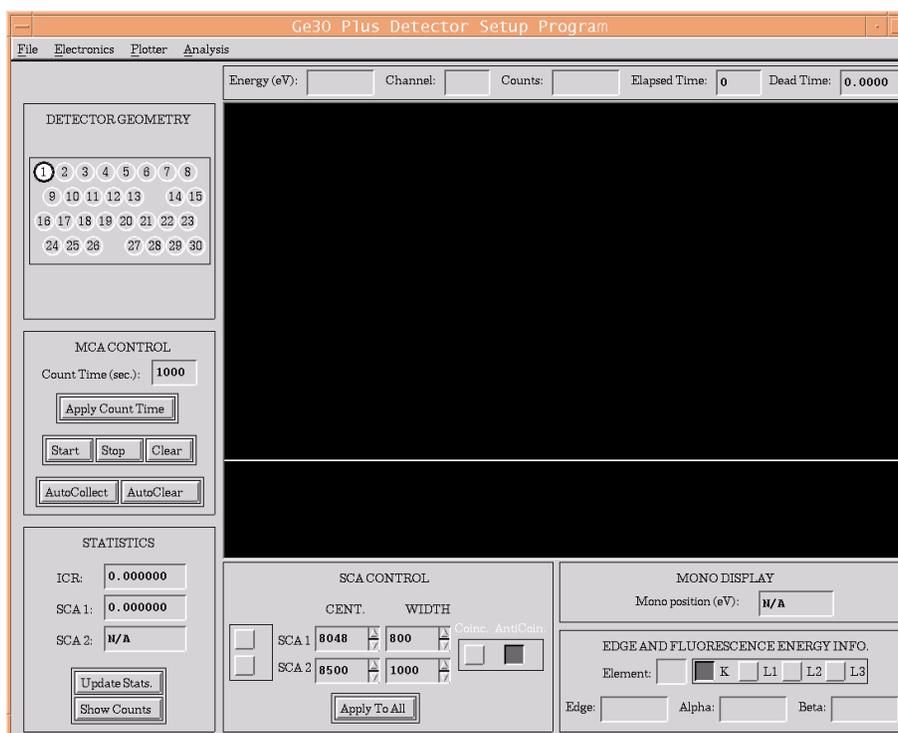
Ge30 Plus Detector Setup Program Main Window

Guide to Using Ge30 Plus

Checking Counts

To check the counts for the selected detector element, press the **Update Stats.** button in the main window. The Incoming Count Rate (ICR) for the selected element, as well as the counts in both SCA windows, will be displayed in the STATISTICS section.

To check the counts for all elements of the detector, click the **Show Counts** button on the main window. The Counts window will appear.
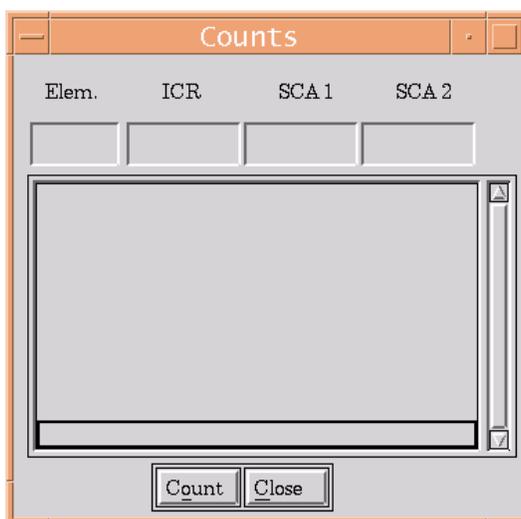
Counts Window

To obtain current count rate information, click the button at the bottom of the window labeled **Count**. If the count rate is too high (see table below), try moving the detector further away from the sample, or using slits or filters to decrease the intensity of the beam. To close the window, press the **Close** button.

The following table provides the suggested maximum incoming count rates for different shaping times:

Shaping Time (μSec)	Suggested Max. ICR (cps)
0.125	110,000
0.250	70,000
0.500	40,000

When counts are collected, the detector element buttons in the DETECTOR GEOMETRY section will be highlighted in color to indicate the incoming count rate.

By default, the color indicators are set as follows:
Red – Indicates an ICR greater than 110,000 counts per second
Orange – Indicates an ICR greater than 70,000 counts per second, but less than 110,000 counts per second
Black – Indicates an ICR less than 70,000 counts per second

To change these indicators, select **ICR Color Indicator** from the **Program Options** menu. Enter the high and moderate count rate thresholds and press **Apply**.

By default, the count time is 1 second. To change the count time, select **Statistics Count Time** from the **Program Options** menu. Enter the new count time and press **Apply**.

Note: All statistics are displayed in terms of counts per second.

Collecting a Spectrum

To collect a spectrum for the selected element, press the **Start** button in the MCA CONTROL section. The spectrum will appear in the plotting area. To stop collecting, press the **Stop** button. To clear the display, press the **Clear** button.

By default, the MCA will acquire a spectrum for 1000 seconds, as indicated by the **Count Time** text field in the MCA CONTROL section. If the preset time is reached, acquisition will stop automatically. To change the preset time from the default of 1000 seconds, enter the desired value in the **Count Time** text field and press the **Apply Count Time** button or press <**Enter**>.

Zoom in on the spectrum by clicking and dragging a box in the lower portion of the plotting area. The portion of the spectrum that is in the box will appear in the upper section of the plotting area. Clicking with the mouse in the upper section of the plotting area will bring up a cursor and update the **Channel**, **Energy**, and **Counts** text fields at the top of the window.

Saving and Opening Spectrum Files

When saving a spectrum file, the most recently collected spectrum of each detector element is saved to a file. To save a spectrum file, select **Save Spectrum File** from the **File** menu. After selecting a file name, a comments window will appear. Enter any comments necessary and then press the **Save** button at the bottom of the window.

To open a spectrum file, select **Open Spectrum File** from the **File** menu. When opening a spectrum file, after selecting a file name, select the element to be displayed. As the file is opening, the comments window will appear to display the comments that were saved in the file.
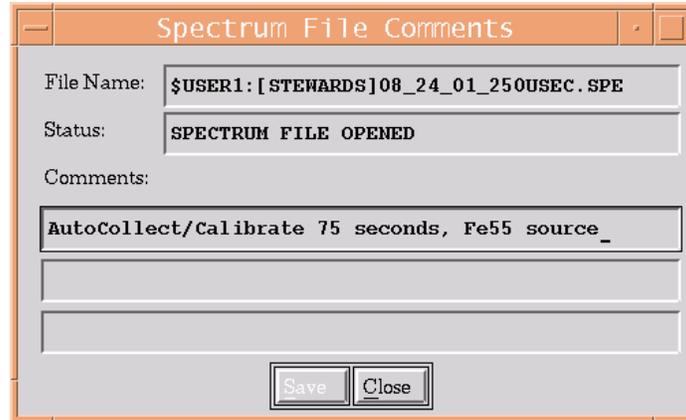
Spectrum File Comments Window

Modifying the Display

To modify the color of a displayed spectrum, or to delete a spectrum that has been opened from a file, select the **Modify Display** item from the **Plotter** menu.

To delete a spectrum from the plotting area, select the plot you would like to delete and press the **Delete Selected** button in the Modify Display window. To change the color of a spectrum, select the plot and press any of the color buttons. To highlight a spectrum, press the **Highlight** button and select the spectrum you would like to highlight. The spectrum will be drawn in yellow and the other spectra will be drawn in blue. To highlight a different spectrum, select it in the scrolling list.
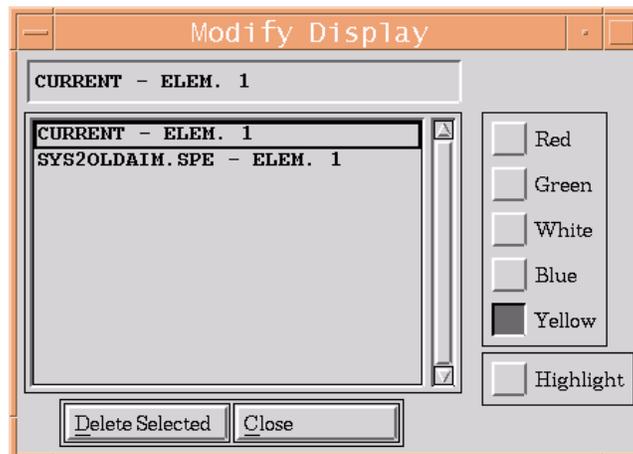
Modify Display Window

Setting SCA Windows

To activate an SCA window, press one of the toggle buttons labeled **SCA 1** or **SCA 2** in the SCA CONTROL section. The windowing procedure we recommend is as follows:

1. In the **CENT.** text field that corresponds to the activated window, enter the energy of the peak you are windowing. In the **WIDTH** text field, enter a reasonable width. Press **<Enter>** to apply the SCA window for the selected detector element.
2. Check the window position by acquiring a spectrum. To display the spectrum in Coincidence, press the **Coinc.** button. Press the **AntiCoin.** button to display the spectrum in Anti-Coincidence.
3. Adjust the window by pressing the centroid and width up/down arrow buttons.
4. Press the **Apply To All** button, and press **Ok** in the message window that appears. This applies the window settings to all detector elements.
5. Check the window position for all detector elements by acquiring a spectrum for each element. Adjust each window by pressing the up/down arrow buttons.

If you prefer to set windows in terms of lower level and upper level, rather than centroid and width, select **Toggle SCA Controls** from the **Program Options** menu.

The default step size for the SCA up/down arrow buttons is 5 eV. To change the step size when using the up/down arrow buttons, select **Set SCA Increment** from the **Program Options** menu. Enter the new step size in the text field and press **Apply**.

Saving and Opening SCA Files

Once the SCA windows have been adjusted, you can edit the amplifier gains in the Amp. Gains window (**Electronics** menu **-> Amp. Gains**), and save the settings by selecting **Save SCA File** from the **File** menu.

Alternatively, to open a saved SCA file, select **Open SCA File** from the **File** menu. This will reset the window positions to the saved values and update the amplifier gains in the Amp. Gains window. If you are opening an old SCA file, the calibration and gain settings may have changed since the file was saved, so check the window positions before collecting data.

Important: When you open an SCA file, the saved window positions are automatically reloaded. Do NOT open an SCA file while collecting data with the Germanium detector.

AutoCollect Feature

Ge30's AutoCollect feature enables you to collect a spectrum for each detector element for a specific collection time. To use the AutoCollect feature, press the **AutoCollect** button in the main window. In the window that appears, enter the starting element (to display all detector elements, enter 1) and the collection time for each element.

A collection time of 3-5 seconds is usually sufficient. Press the **Start** button to begin displaying. The program will then collect a spectrum for each channel for the specified collection time. Once it is done collecting, you can go back to each channel to look at its spectrum.
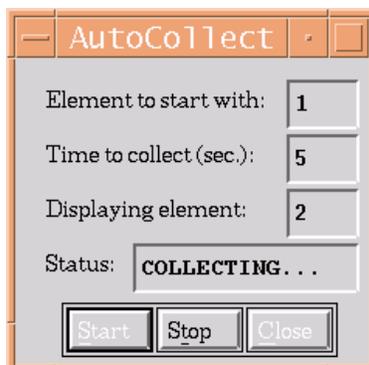
Auto Collect window

AutoClear Feature

Ge30's AutoClear feature is useful for calibrating the detector. AutoClear makes it easier to adjust the gain for the selected detector element by starting acquisition and repeatedly clearing the display after a specified time interval. This enables you to easily see how the changes in gain have affected where the spectrum appears. To use the AutoClear feature, press the **AutoClear** button in the main window. In the window that appears, enter the time to collect before clearing the MCA. One or two seconds is generally sufficient. To start acquisition, press the **Start AutoClear** button in the AutoClear window. To stop acquisition, press the **St**op AutoClear** button.
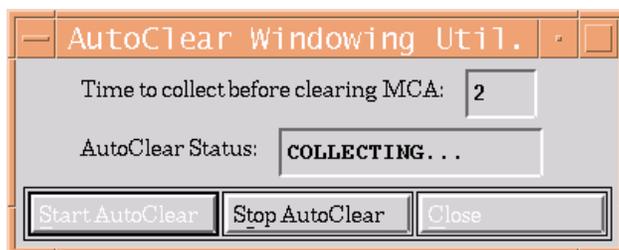

AutoClear Window

Setting Energy Range

By default, Ge30 Plus only displays spectra up to 24 keV. The SCA windows are also limited to this range. If you need to window on fluorescence peaks that are higher than 24 keV, you will need to adjust the energy range.

> **Important:** It is strongly recommended that you contact SMB-XAS detector support staff for assistance in changing the energy range.

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Select the **S_e_t Energy Range** menu item from the **Electronics** menu. In the text field, enter the maximum energy to be displayed and press **Apply**.
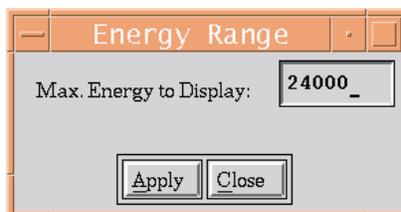

Energy Range Window

Using a reference foil, align the amplifier gains so that peaks in the spectrum appear at the proper energy by following this procedure:

1. Place a reference foil in the beam and check counts on the detector. If the incoming count rate is too high (> 110,000 counts per second at 0.125 _Sec shaping time), move the detector back or insert Al filters.
2. Select detector element 1 and press the **Start** button in the MCA CONTROL section.
3. Move the MONO above the edge of the reference foil. Make sure the MONO is high enough above the edge that the fluorescence peaks cannot be confused with the scatter peak. (Ex: If you are using a manganese reference foil, since the K-edge is at 6539 eV, move the MONO to 7500 eV.) The fluorescence peaks should be easily distinguishable – if you have any problems distinguishing different peaks in the spectrum, please contact SMB-XAS detector support staff.
4. Zoom in on the region where the peak should fall. (Ex: The Mn K-Alpha fluorescence peak should appear at 5898 eV.)
5. Click in the zoom region to bring up a cursor. Check the **Energy** text field at the top of the screen. Move the cursor until it is as close as possible to the correct energy for the peak (Ex: approximately 5898 eV for Mn). You may need to reposition the zoom box to be able to find the correct energy.
6. With detector element 1 selected, adjust the fine gain on amplifier 1 in the detector electronics rack until the fluorescence peak of the reference foil is centered on the cursor. You may also need to adjust the coarse gain on the amplifier.
7. Apply a window to the fluorescence peak. (Ex: For Mn K-Alpha, enter a centroid position of 5898 and a width of 300.) The SCA window should appear roughly centered around the appropriate peak.
8. Repeat Steps 6-7 for each detector element.

ADC Parameters

To view or change the ADC settings, select **A<u>D</u>C Parameters** from the **Electronics** menu. Enter the new parameters and press **<u>A</u>pply** to apply the new settings. Press **C<u>u</u>rrent** to update the display with the current ADC settings. **<u>C</u>lose** closes the window.

Generally, users should not have to change the ADC parameters. Please consult SMB-XAS detector support staff if you have questions regarding the ADC.
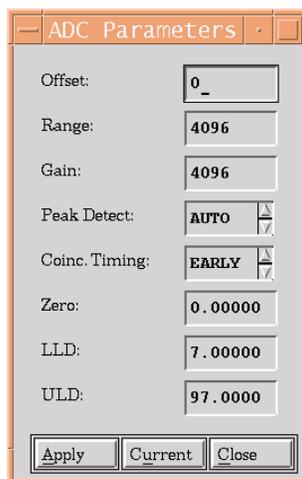

ADC Parameters Window

Measuring Detector Resolution

To measure the Area, Integral, Centroid, and Full Width Half Max (FWHM) of a detector element, collect a spectrum for that element. To ensure accuracy, collect until the spectrum is fairly smooth. Select **<u>A</u>nalyze ROI** from the **<u>A</u>nalysis** menu and enter the element number. Define the region of interest by entering the Start and Stop energies in the text fields at the top of the window. Press the **<u>C</u>ompute ROI** button to perform the calculations. The results will be displayed in the text fields at the top of the window and in the scrolling list.

To perform the calculations for all detector elements, first use the AutoCollect feature to collect a spectrum for each element. Then define the region of interest as described above and press the **Compute <u>A</u>ll ROI** button.
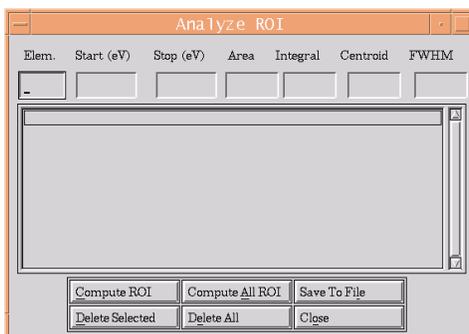
Analyze ROI Window

MONO Display

The MONO DISPLAY section displays the monochromator position. It is updated whenever the MCA is started or cleared – it is not displayed in real-time.

No motion control of the MONO is available through Ge30. Please use XAS or ICS_CMD to move the MONO.

Edge And Fluorescence Energy Information

If you would like to look up the K or L edge energies of the element you are windowing, you can enter the element symbol in the EDGE AND FLUORESCENCE ENERGY INFO. section and press **<Enter>**. Select the edge you are interested in. The edge and fluorescence energies will be displayed in the text fields at the bottom of the section.

Exiting And Restarting Ge30 Plus

Important: You must exit Ge30 by using the **Exit** menu item in the **File** menu. If the program does not exit correctly – for example, by closing the DEC term window that Ge30 is running from, or by crashing – the appropriate exit functions are not called and could create problems when you try to restart the program.

If you encounter problems while trying to restart Ge30, issue the command "MCADELETE" at the VMS prompt:
        $ MCADELETE

If you receive error messages when executing this command or if you are still having problems restarting Ge30, please contact SMB-XAS detector support staff.

File Formats

All files used and saved by Ge30 are ASCII text files so they can easily be read and exported to other programs if necessary. Any of the files generated by Ge30 can be modified by hand, though this is not recommended. Comments are delimited by the pound ("#") symbol. All characters on the same line as, and following, a "#" are ignored by Ge30.

Detector Setup File

This file contains all setup information required to communicate with the AIM and ICS, as well as the detector geometry information. The DETECTOR_SETUP logical should be assigned to point to this file in the SETUP_DETAPP.COM command file. Only SMB-XAS detector support staff should modify this file.

The file format is described thoroughly in the **Setting Up Ge30** section of this document.

Calibration File

This file contains the maximum energy to be displayed and the SCA calibration information. The file is saved every time Ge30 exits, and is reloaded every time Ge30 is launched. The logical CALIBRATION_DAT should be assigned to point to this file in the SETUP_GE.COM command file.

The file format is as follows:

Maximum energy – Maximum energy to be displayed in the plotting area.
LL bit – Lower level SCA calibration point.
UL bit – Upper level SCA calibration point.
SCA calibration information – Five columns of data, with each row containing the SCA calibration information for each element:

> **Element number** – Detector element number.
> **LL channel** – Channel position of the SCA window lower level, where the SCA window is between "LL bit" and "UL bit".
> **UL channel** – Channel position of the SCA window upper level, where the SCA window is between "LL bit" and "UL bit".

Edge and Fluorescence Energy Information File

This file contains the edge and fluorescence energy information for every (chemical) element. The logical EDGE_FLUOR_HLD logical should be assigned to point to this file in the SETUP_DETAPP.COM command file.

The file is formatted with ten columns, and has a row for each element.

Atomic # - Atomic number.
Symbol – Chemical symbol.
K – Energy of K edge.
L1 – Energy of L1 edge.
L2 – Energy of L2 edge.
L3 – Energy of L3 edge.
K-Alpha – Energy of K-Alpha fluorescence line.
K-Beta – Energy of K-Beta fluorescence line.
L-Alpha – Energy of L-Alpha fluorescence line.
L-Beta – Energy of L-Beta fluorescence line.

Spectrum Files

Spectrum files are saved and opened by Ge30 users. The default file extension for spectrum files is ".SPE". The spectrum of every detector element is saved in the file.

The file format is as follows:

"Comments" - The first word of the file should be "Comments" to delimit where the three lines of comments start.
Comment lines – The next three lines in the file are comments entered by the user.
Number of elements – Number of detector elements.
Number of channels – Number of spectrum channels.
On/Off – Row of 0's (off) and 1's (on) corresponding to each detector element, to indicate whether or not the element has a non-zero spectrum.
Spectrum data – The rest of the file contains a table with the number of rows equal to the number of spectrum channels and the number of columns equal to the number of detector elements. Each column corresponds to a detector element, starting with element one. Each row corresponds to a channel in the spectrum.

SCA Files

SCA files are saved and opened by Ge30 users. The default file extension for SCA files is ".SCA". The amplifier gains and SCA lower level and upper level settings are saved in the file.

The file format is as follows:

Number of elements – Number of detector elements.
SCA window and amplifier gain settings – Seven columns of data with a row for each detector element, containing the SCA window settings and amplifier coarse and fine gain settings:

   Element number – Detector element number.
   SCA 1 LL – SCA 1 lower level.

SCA 1 UL – SCA 1 upper level.
SCA 2 LL – SCA 2 lower level.
SCA 2 UL – SCA 2 upper level.

All lower level and upper level settings are saved in terms of energy.